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(19) (CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Magnetic Fluid Modifier

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(71) Same as inventor

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(57) 22 Claims

Notice: This application is as filed and may therefore contain an incomplete specification.

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Abstract of the Disclosure

The invention relates to a device for magnetically treating a fluid being transported through a conduit. At least one pair of magnets is disposed peripherally on the conduit and in angular spaced relation such that the longitudinal central axis of each magnet is substantially normal to a radius of the conduit, and the planar pole faces of each pair of magnets define an obtuse angle. Each magnet along its longitudinal axis is bisected by three bi-polar fields thereby forming six poles with alternating magnetic poles facing the conduit.

MAGNETIC FLUID MODIFIER

Field of the Invention

This invention relates to a magnet assembly or magnetic modifier for treating a fluid transported through a conduit, and to the magnetic device for treating a fluid. In its more specific aspect, this invention relates to a magnetic fluid device having a magnetic assembly for improving the efficiency of combustion of fuel, and to prevent the formation of objectionable scale deposits in the conduit transporting a fluid.

Background of the Invention

The phenomenon of magnetically induced ionization of a fluid passing through a line or pipe has been studied now for years, and the prior art discloses a number of magnetic devices for accomplishing this effect. It has been proposed to magnetically modify a fuel, including gas and liquid fuels, to improve combustion efficiency and to reduce pollution. Also, scale deposits on the inside of the conduit or pipe fittings is common not only in fuel lines but in water lines as well, and the prior art shows that the magnetic treatment of the fluid can reduce or substantially prevent the formation of this objectionable scale. A relatively strong magnet is placed axially of the fluid line, that is, adjacent the fluid path, and typically prior to the combustion zone or to the fuel filter or the fuel injector. Further, some magnetic devices are arranged internally of the conduit, and others are disposed concentrically on the exterior

surface of the line. Many proposed devices are expensive, or not adaptable to different size lines or conduits, or are inconvenient to install, especially with those devices internally mounted in the line or conduit.

Magnetic fluid devices of the above type are shown, for example, in U.S. patents 4,430,785 to Sanderson and 5,348,050 to Ashton. In the Sanderson patent, the magnetic device (see Figure 1) containing magnet 88 and retained by an inner casing is connected to the fuel lines 46 and 48. In Ashton, the magnets 18 and 20 are retained in the steel pipe 12 which surrounds the fluid conduit.

In U.S. patent 5,161,512 to Adam et al., the magnetic poles are arranged in a helical pattern, and like magnetic poles face the conduit. This feature of like poles facing the conduit is also disclosed in U.S. patents 5,129,382 to Stamps, Sr. et al. and 5,320,751 to Burns. The device disclosed in U.S. patent 5,124,045 to Janczak et al. is mounted on the exterior surface of the conduit, and comprises a pair of magnets stradling an arc of the pipe such that the south magnetic pole is oriented downstream in the fuel line. All this art shows either relatively complicated mounting devices, or requires unique mounting arrangements.

This invention has, therefore, as its purpose to provide a magnetic fluid modifier for treating a fluid flowing through a conduit having a greater magnetic effectiveness than that taught by the prior art known to applicant.

It is another object of the invention to provide a magnetic

fluid modifier for treating fuel, either gas or liquid fuel, thereby achieving improved combustion efficiency and a reduction in pollutants.

It is yet another object of the invention to provide a magnetic fluid modifier that will reduce or substantially prevent the formation of scale deposits on the inside of the conduit or pipe.

Still another object of the invention to provide a magnetic device for treating fluid transported through a line or pipe that is simple to install, requiring no special tools or skills, is adaptable to different size lines, and is maintenance free.

Another object of the invention is to provide a magnetic device having an encasement or housing that mounts the magnets onto the periphery or exterior of the conduit or line in a predetermined arrangement that will provide for an effective flux concentration across the flow of fluid in the conduit.

Summary of the Invention

In accordance with the present invention, there is provided a magnet assembly mounted on the exterior or periphery of a conduit or line transporting a fluid, such as a gas or liquid fuel or water. The magnets are permanent ceramic magnets, and each magnet used for treating the fluid is bisected along its central longitudinal axis or plane by three bi-polar fields thereby forming six poles. At least one pair of magnets is used in each assembly, and the magnets are arranged on the outer circumference of the pipe

in a V-like configuration as viewed in transverse cross-section with the longitudinal central axis of the magnets in each pair being substantially parallel. As a result of this angular relation, the longitudinal marginal edges nearest the conduit for each of the magnets are in juxtaposition, and the longitudinal central axis of each magnet in the pair is substantially normal to a radius of the conduit. Thus, the two radii drawn to each magnet of the paired assembly define an acute angel, and the planar pole faces of the pair of magnets adjacent or tangential to the conduit surface define an obtuse angle. It should be understood, however, that the degree of angularity may vary somewhat depending on the relative sizes of the magnets and the diameter of the conduit, and the terms "substantially normal", "acute" and "obtuse" as used herein and in the appended claims are used with this understanding in mind. For each magnet, alternating magnetic poles face the conduit wall, and when the pair of magnets is disposed in angular relation, the magnets may be arranged so that like magnetic poles of the pair of magnets face angularly toward each other, or the magnets may be arranged so that opposite polarity of the pair of magnets face angularly toward each other. When arranged so that opposite poles face each other, the magnetic field is more concentrated. However, I have found that generally when the magnetic assembly is fitted to a conduit comprised of magnetic material, e.g., iron or steel, it is preferable to arrange the pair of magnets so that like poles are facing each other. Preferably, a shield of ferrous metal or other appropriate material is disposed

over the assembly on the outer surface of each magnet so as to contain the magnetic field and direct it toward the fluid.

It is important that the magnetic field cover substantially the entire area or zone of the fluid flowing in the line with a high flux concentration. For a large pipe, it may be desirable to use two pairs of magnetic assemblies. Each pair is placed opposite each other on the exterior surface of the pipe, and can be arranged so that like polarity of the magnets face each other, or that opposite polarity face each other, as explained above. Because each magnet is bisected by three bi-polar fields, even if the pairs are fitted to the pipe so that opposite poles face each other, there is essentially no problem of the magnetic field being short-circuited and the field penetrating only a portion of the cross-sectional area of the fluid which could minimize the effectiveness of the magnetic treatment. If more magnetic assemblies are required because of the pipe size diameter, pairs of the assemblies are aligned longitudinally on the conduit, and preferably in abutment.

There is provided in a preferred embodiment of the invention a magnetic device comprising a housing or receptacle of non-magnetic material for retaining at least a pair of magnets in spaced and angular relation. The housing comprises, in general, a bottom portion or lower member as the main receptacle member adaptable for receiving and retaining a pair of magnets, and having opposed end walls, a substantially inverted V shaped base as viewed in transverse cross-section, and side walls diverging upwardly away

from the base. The housing further includes a top member or cover, which preferably comprises opposed end walls and upwardly converging side walls thereby forming a recess in the cover. Further, the cover is securable to the bottom portion, and preferably the two members are releasably connected in order to provide access to the container at any time, such as by a co-acting latch means carried by the two members for securing the members in their closed position.

The magnets are of substantially rectangular configuration, and when the magnets are inserted into the bottom member, the angular base and diverging side wall provide a seat for the magnet, and each magnet will be retained at an angle so that the bottom planar surface of each magnet can be pictured as being substantially tangential to the outer surface of the pipe. Further, the recess in the cover is adaptable to receive at least a portion of the top of the magnet, and when the cover is attached, the top planar surface of the magnet of each magnet will rest against or abut the end walls and the converging side walls of the cover. The lower longitudinal marginal edges of each magnet are substantially parallel and adjacent, but preferably slightly spaced, whereby the interiorly disposed side walls of the two magnets define a V as viewed in transverse cross-section. In a preferred embodiment, the groove formed by the V is filled with a potting compound such as a silicone or a curable epoxy resin. Also, it is preferable to provide a ferrous metal shield on the outwardly disposed planar surfaces of the magnets in order to

retain the magnetic field in the capsule and to direct the field toward the fluid flowing in the pipe line. In this manner, the receptacle provides a compact enclosure for the magnets, retains the magnets in the desired angular relationship, and prevents the magnets from moving. The magnetic device containing at least one pair of magnets is disposed peripherally, that is, on the exterior surface, of a conduit, by placing the inverted V-shaped base of the receptacle onto the periphery of the conduit and securing the receptacle in place such as with self-locking plastic straps. The receptacle retains the magnets in angularly spaced relation such that the longitudinal central axis of each magnet is substantially normal to the radius of the conduit.

Where desired, and particularly for pipes of relatively large diameter, the magnetic device may have two or more pairs of magnets encapsulated in the same receptacle. In so doing, the magnets are aligned end-to-end in the V-shaped recess of the bottom portion of the receptacle. Also, two or more magnetic devices may be attached to a larger pipe by securing a receptacle containing the magnets on opposite sides of the pipe.

Brief Description of the Drawings

Figure 1 is a perspective view of a pair of magnets in angular relation used in the magnet assembly of the present invention and positioned on the periphery of a conduit.

Figure 2 is an end view of the magnetic assembly of Figure 1 positioned peripherally on a conduit.

Figure 3 is a plan view of Figure 2.

Figure 4 is a perspective view of a magnetic device of the present invention comprising a receptacle or encasement for enclosing the magnetic assembly of Figures 1 and 2.

Figure 5 is an end view of the magnetic device of Figure 4 positioned on a pipe.

Figure 6 is a side view of the magnetic device of Figure 5.

Figure 7 is a transverse cross-sectional view taken on line 7-7 of Figure 4.

Figure 8 is a longitudinal cross-sectional view taken on line 8-8 of Figure 4.

Figure 9 is an exploded perspective view of an alternative embodiment of the invention showing four magnets assembled for enclosure by the receptacle.

Detailed Description of the Invention

Referring to the drawings wherein like reference numerals refer to similar parts throughout the several views, there is shown in Figures 1-3 a mangetic assembly, indicated generally by the numeral 10, comprised of a pair of magnets angularly disposed on the exterior or periphery of a pipe or conduit 12 transporting a fluid, as explained herein below in greater detail. Each magnet 14 and 16 of the pair is a permanent, anisotropic ceramic magnet, and along the central longitudinal plane of the magnet, shown in phantom, the magnet is bisected by three bi-polar fields, thereby forming six magnetic North and South poles (designated N and S) as

shown in Figures 1 and 3. Thus, the three bi-polar fields each have a North and South pole, and the poles for each magnet alternate in polarity along the longitudinal axis, thereby totaling six magnetic poles with opposite poles adjacent. Magnets especially suitable for use in the present invention are composed of a strontium ferrite ceramic, or a rare earth ferrite ceramic such as cerium, neodymium, and the like. Fluids which may be treated or modified in accordance with the invention include fuel, such as natural gas, gasoline, liquid propane, gasahol, fuel oil, Deisel fuel, etc., and water. Treatment enhances the combustion efficiency of the fuel, and reduces emissions or pollutants, and prevents the build-up of scale such as lime as well as waxes or greases. Each assembly or device comprises at least one pair of magnets encased in a suitable housing or receptacle 18 of non-magnetic material (see Figure 4) described below in detail. The encased device is arranged on the outer circumference or periphery of a pipe or conduit 12, substantially as seen if Figures 5 and 6.

The views shown in Figures 1-3, however, best show the arrangement of the magnets, per se, utilized in the device but without showing the housing. As best seen in Figure 2, each magnet is arranged on the pipe so that the planar pole face of each magnet is substantially tangential to the circumference of the pipe. The inwardly disposed, longitudinal marginal edges 20 and 22 are substantially parallel and adjacent but not contiguous, as shown in Figures 2, 3 and 7. The longitudinal central axis of each magnet is substantially normal to a radius 24 of the pipe 12. It

will be observed that the two radii define an acute angle, and that the planar pole faces adjacent the pipe define an obtuse angle. By reason of this angular relation or diposition, and because of the unique polarity of the magnets, a high concentration of magnetic flux is imposed across a large cross-sectional area of the fluid flowing in the pipe, and preferably substantially all of the fluid flows through the magnetic field.

As a general rule, the composition of the conduit is of little or no consequence, and the conduit can be ferrous or non-ferrous. If the magnetic device is fitted to a pipe of a ferrous material, it may take time to "bed in" before any effect is noticed, but this time required is relatively short, usually about 24 hours. If the pipe is a ferrous material or magnetic material, it is preferable to arrange the magnets so that like polarity face angularly toward each other. When the pipe is a non-ferrrous or non-magnetic material, such as copper or plastic, the arrangement of the magnets is best when opposite polarity face angularly toward each other, which provides for a more concentrated magnetic field.

It is preferable to provide a ferrous metal shield or bracket 26 on the outer surfaces of the magnets. The shield, typically a steel shield, helps to prevent the loss of the magnetic field outwardly from the conduit, and conversely to direct the magnetic field toward the fluid flowing through the pipe. It is preferable that the shield nearly completely cover the outwardly disposed planar face of the magnets, substantially as shown in the drawings.

Referring now to Figures 4-8, there is shown a preferred

embodiment of the magnetic device comprising at least one pair of magnets arranged in an appropriate encasement or receptacle 18 suitable for mounting directly onto the exterior of a pipe. The magnets are retained in the angular relationship by the receptacle or case, which is formed of a non-magnetic material, such as a plastic polymer or compolymer, formed, for example, by extrusion molding. Receptacle 18 comprises a bottom member 28 and top member or cover 30. The bottom member has substantially parallel end walls 32, and a V-shaped base 34 (as viewed in transverse cross-section) so that the faces of each side of the V extend obtusely with respect to each other. As best seen in Figure 5, when the device is mounted or fitted to a pipe 18, the V-shaped base bears against the exterior of the pipe, which is important as explained below. Side walls 36 of the bottom member diverge upwardly from the base, and terminate at each periphery with laterally projecting flanges 38 extending the length of the bottom member. Elongated rib 40 extends longitudinally the length of the case 18 along the inside and at the apex of the V base. It will be observed that base 34 and side walls 36 form a seat for each magnet, and as a result retain each magnet at the desired angle. Further, the longitudinal marginal edges 20 and 22 of the magnets abut the rib 40, and a potting compound 42, such as a silicone or epoxy resin, is added to fill at least a portion of the space between the angled magnets. Thus, the rib and potting compound help to keep the magnets in place in the receptacle. The magnets always have a tendency to attract each other, and therefore if loose, the angular

relationship of the magnets could be upset. Hence, the configuration of the bottom member of the receptacle and the potting compound are important in retaining the magnets in their proper angular relationship and thereby directing the magnetic field in the desired direction to the fluid flowing through the conduit.

Cover 30 of the receptacle has a top wall 44, diverging side walls 46, and parallel end walls 48, thereby forming or defining a recessed cover. The side walls 46 terminate at the longitudinal periphery of each with a lateral flange 50, which seats against lateral flange 38 of bottom 28 when the receptacle is in a closed position. The cover 30 is releasably secured to the bottom 28 along the length of the flanges 38 and 50. The two members may be secured by any suitable means 52 such as a co-acting latch means, a latching tab and recess, or tongue and groove means. When the receptacle is closed, the magnets, including the metal shield, are in close proximity to the interior wall surfaces 44 and 46. Thus, the defined recess in the cover co-operates with the bottom member in retaining the magnets in place.

The magnetic device, as encased, is mounted on the exterior of a conduit or pipe, such as a fuel line for transporting natural gas. Thus, mounting is easily accomplished by using a flexible strap 54, such as self-locking plastic strap. Latch means 52 is provided with an opening or eye 56, and the strap 54 is threaded through the eye, and around the periphery of the receptacle and the pipe, and then locked in place. In this manner, the device is

secured to the pipe, with the V base bearing against the pipe. A magnetic field is then directed toward the fluid passing through the pipe.

It may be desirable in some circumstances to install on a pipe two or more magnetic devices, or a larger device containing more than a single pair of magnets. For example, if the pipe is a large diameter, or if the fluid is traveling at a fast velocity, it may be desirable to install two magnetic devices on opposite sides of the pipe. If still more magnetic devices are required, the devices are aligned end-to-end along the longitudinal axis of the pipe. Also, it may be desirable to use a larger device containing two pairs of magnets. As shown in Figure 9, the receptacle holds four magnets 14, 14a, 16 and 16a. The magnets are retained primarily by the bottom member 28 of the receptacle, and the magnets are aligned end-to-end on each side such that magnets 14 and 14a are in alignment and abut on their inside faces, and magnets 16 and 16a likewise are aligned and in abutment. Except for this modification, the magnetic device is assembled as described above, and is then ready for installation on a pipe.

In order to demonstrate the utility of the invention, a magnetic device was mounted onto the exterior of a fuel line transporting natural gas to the boiler of an office building. After 12 months of installation, the user reported a savings in fuel costs of 30.4%. Also, the magnetic device was installed on the natural gas line of an aluminum casting mill using seven gas fired furnaces. After three months, for a single shift, there was

reported a savings of 10.1%, and for the same mill, 10.6% for a double shift.

It will be observed that by reason of my invention numerous advantages are achieved in providing a magnetic device for treating a fluid such as a fuel or water. Further, it should be understood that the foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

CLAIMS

1. A device for magnetically treating a fluid being transported through a conduit, comprising:

(a) at least one pair of magnets disposed peripherally on said conduit and in angular spaced relation such that the longitudinal central axis of each magnet is substantially normal to a radius of said conduit, and the planar pole faces of each pair of magnets defining an obtuse angle; and

(b) each magnet along its longitudinal axis being bisected by three bi-polar fields thereby forming six poles with alternating magnetic poles facing said conduit.

2. A device for magnetically treating a fluid according to claim 1 wherein when said at least one pair of magnets is disposed in angular relation, like magnetic poles of said pair of magnets face angularly toward each other.

3. A device for magnetically treating a fluid according to claim 1 wherein when said at least one pair of magnets is disposed in angular relation, opposite magnetic poles of said pair of magnets face angularly toward each other.

4. A device for magnetically treating a fluid according to anyone of claims 1-3 and further including a ferrous metal shield disposed on the surface of said magnets outwardly from the conduit.

5. A device for magnetically treating a fluid according to anyone of claims 1-3 wherein said magnets are anisotropic strontium ferrite ceramic magnets.

6. A device for magnetically treating a fluid according to claim 4 wherein said magnets are anisotropic strontium ferrite ceramic magnets.

7. A device for magnetically treating a fluid according to anyone of claims 1-3 wherein said magnets are anisotropic rare earth ferrite ceramic magnets.

8. A device for magnetically treating a fluid according to claim 7 wherein said rare earth is neodymium

9. A device for magnetically treating a fluid according to claim 4 wherein said magnets are anisotropic rare earth ferrite ceramic magnets.

10. A device for magnetically treating a fluid according to claim 9 wherein said rare earth is neodymium.

11. A device for magnetically treating a fluid being transported through a conduit, comprising: (a) a housing of non-magnetic material adaptable for retaining at least one pair of magnets for disposition peripherally on said conduit and in angular spaced relation such that the longitudinal central axis of each magnet is substantially normal to a radius of said conduit, and the planar pole faces of each pair of magnets defining an obtuse angle; and (b) each magnet along its longitudinal axis being bisected by three bi-polar fields thereby forming six poles with alternating magnetic poles facing said conduit.

12. A device for magnetically treating a fluid according to claim 11 wherein said housing includes a bottom portion having opposed end walls, a base substantially V-shaped in transverse cross-section, and side walls diverging upwardly from said base, whereby said magnets are retained in spaced angular relation by said base and said side walls.

13. A device for magnetically treating a fluid according to claim 12 wherein said housing fruther includes an inwardly disposed, longitudinally extending rib at the apex of said V-shaped base thereby retaining in spatial relationship the longitudinal marginal edges of the magnets of said pairs.

14. A device for magnetically treating a fluid according to anyone of claims 11-13 and further including a ferrous metal shield disposed on the surfaces of said magnets outwardly from the conduit.

15. A device for magnetically treating a fluid being transported through a conduit, comprising: (a) a housing of non-magnetic material adaptable for retaining at least one pair of magnets for disposition peripherally on said conduit, said housing including (i) a bottom member having opposed end walls, a base substantially V-shaped base in transverse cross-section, and side walls diverging upwardly from said base, thereby forming a seat for said magnets such that the longitudinal central axis of each magnet is substantially normal to a radius of said conduit, and the planar pole faces of each pair of magnets defining an obtuse angle, (ii) a cover having opposed end walls and upwardly converging side walls thereby defining a recess adaptable to accommodate the top planar zone of said magnets, (iii) an inwardly disposed, longitudinally extending rib at the apex of said V-shaped base thereby retaining in spatial relationship the longitudinal marginal edges of the magnets of said pairs, and (iv) means for releasably connecting said cover to said bottom member, whereby said pairs of magnets are retained securely by said housing; and (b) each magnet along its longitudinal axis being bisected by three bi-polar fields thereby forming six poles with alternating magnetic poles facing said conduit.

16. A device for magnetically treating a fluid according to claim 15 and further including a ferrous metal shield disposed on the surfaces of said magnets outwardly from the conduit.

17. A device for magnetically treating a fluid according to anyone of claims 11-13, 15 and 16 wherein said magnets are anisotropic strontium ferrite ceramic magnets.

18. A device for magnetically treating a fluid according to claim 14 wherein said magnets are anisotropic strontium ferrite ceramic magnets.

19. A device for magnetically treating a fluid according to anyone of claims 11-13, 15 and 16 wherein said magnets are anisotropic rare earth ferrite ceramic magnets.

20. A device for magnetically treating a fluid according to claim 14 wherein said rare earth is neodymium

21. A device for magnetically treating a fluid according to claim 14 wherein said magnets are anisotropic rare earth ferrite ceramic magnets.

22. A device for magnetically treating a fluid according to claim 21 wherein said rare earth is neodymium.

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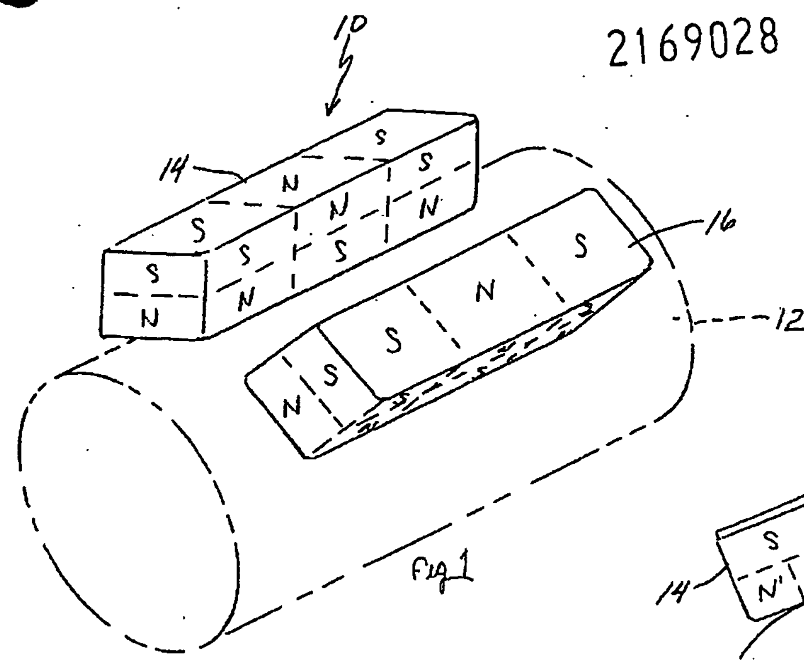

Fig 1

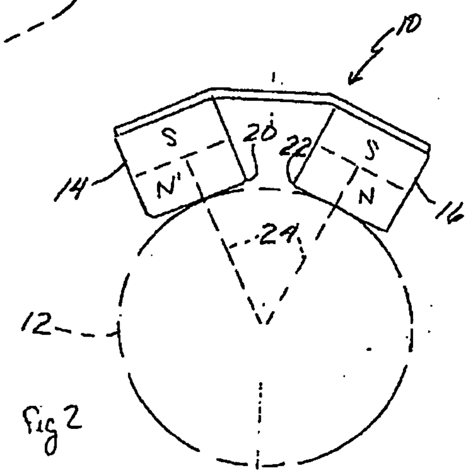

Fig 2

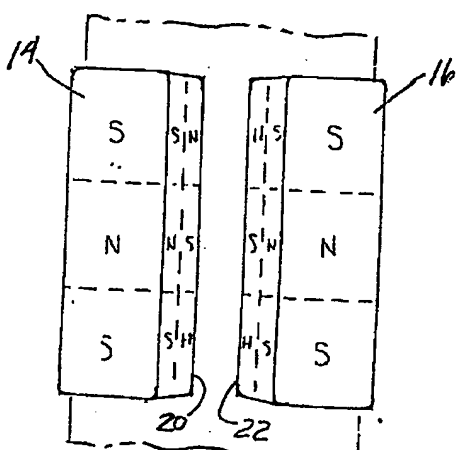

Fig 3

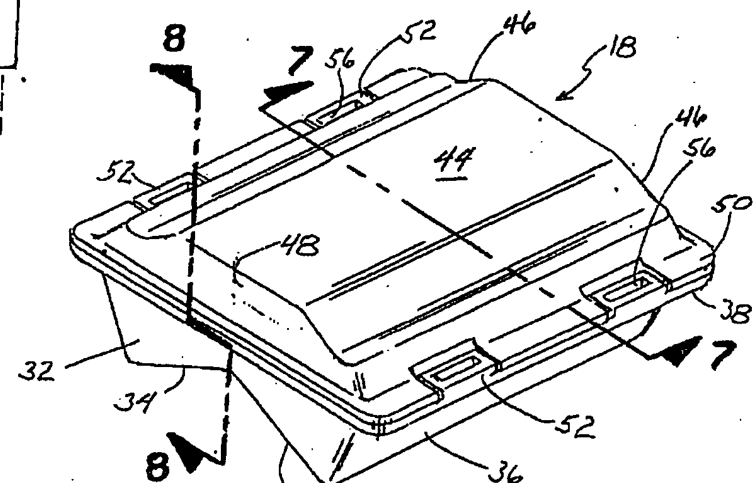

Fig 4

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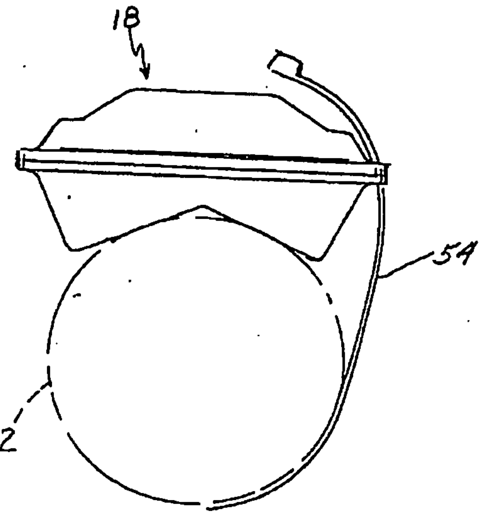

Fig 5

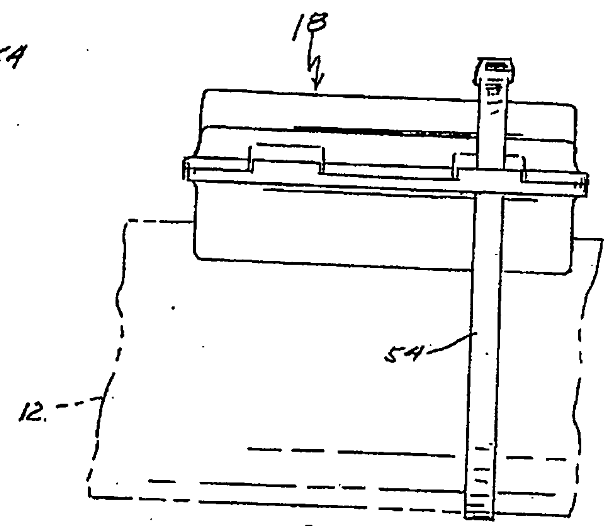

Fig 6

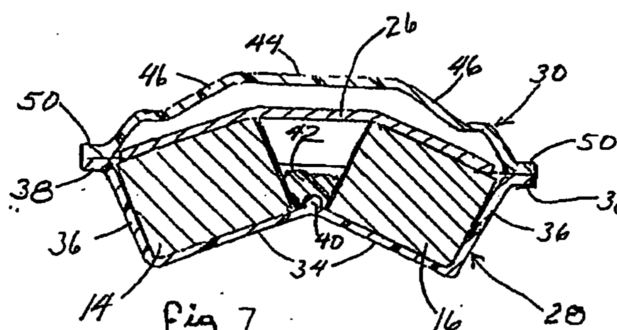

Fig 7

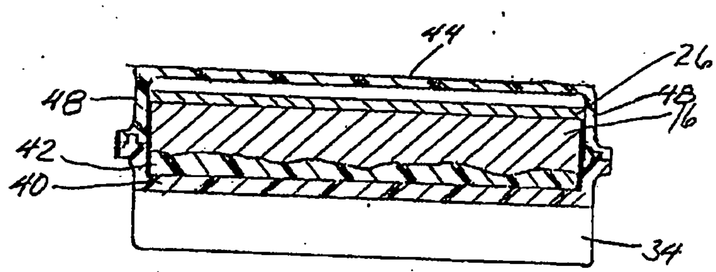

Fig 8

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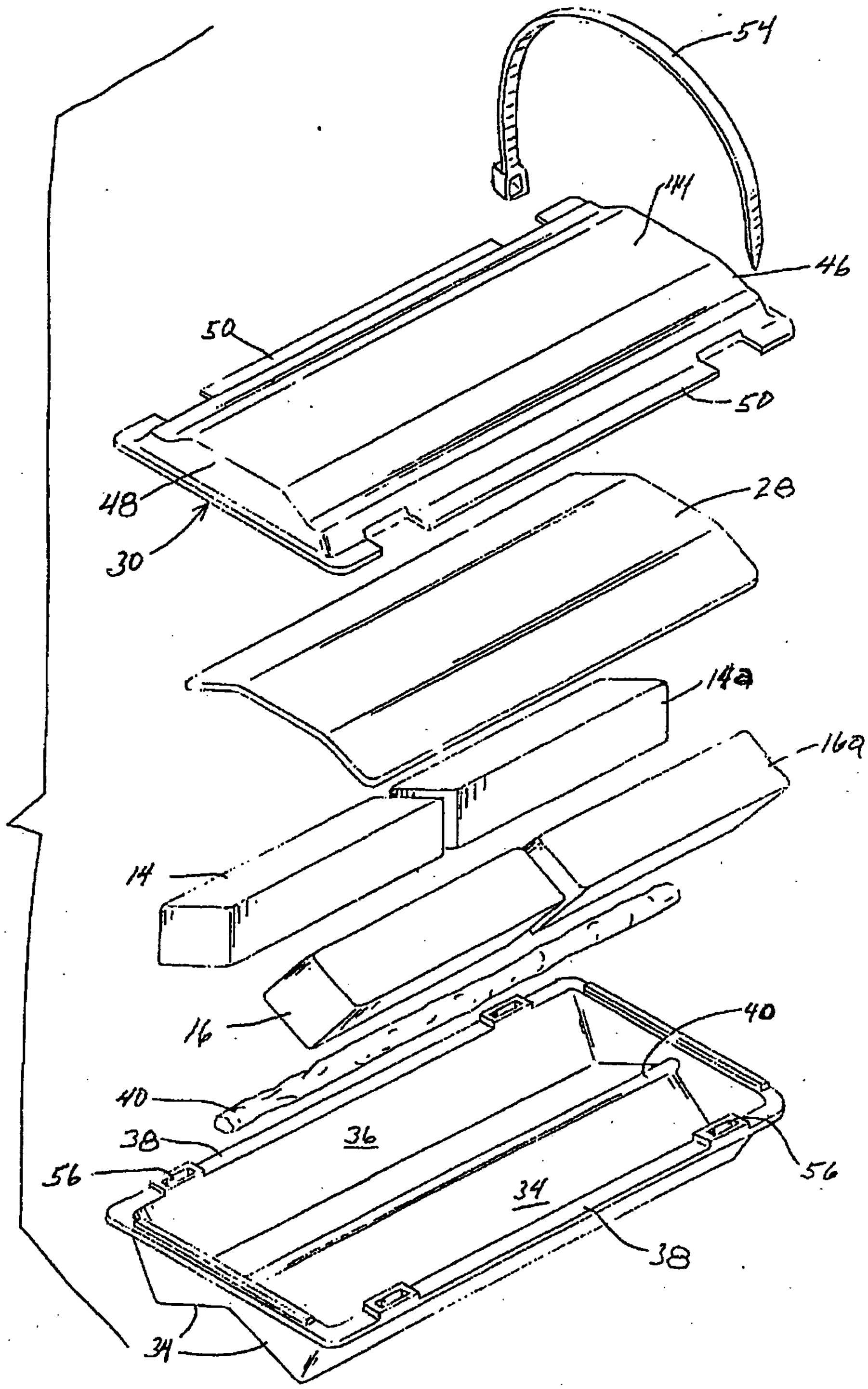

Fig 9

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